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ABSTRACT

A study investigated the role of prior knowledge in ambiguous text interpretation by directly measuring readers' knowledge of, and level of involvement with, three distinct topical domains that could be assigned during reading of an ambiguous passage. Subjects, 52 athletes of average or above average reading ability competing in one of three interscholastic spring sports (tennis, golf, or softball/baseball) for one small rural and one large suburban Illinois high school, read an ambiguous passage that could be taken to be about any of the three sports, free-wrote about the passage, and answered a series of multiple-choice questions which included five randomly ordered choices representing aspects of either tennis, baseball, or golf. The investigation offered some interesting insights, for example: (1) evidence for a prior knowledge effect due to group membership was observed especially in the case of baseball players; (2) the golfers and tennis players, despite direct participation, demonstrated somewhat less domain knowledge of their respective sports than they did of baseball; (3) and across subjects, high positive relationships were observed between each sport's respective prior knowledge and level of involvement scores. Findings suggest that the conclusions of earlier ambiguity studies should probably be reconsidered in light of the complex interrelationships that appear to exist between prior knowledge and level of involvement variables. (One table of data is included; 12 references are attached.) (RS)

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Running head: Ambiguous Text Interpretation

The Influence of Readers' Prior Knowledge and Level of Involvement on Interpreting Ambiguous Text

For well over a decade, the role of prior knowledge in the interpretation of written text has been a central focus of reading research and theory (Pace, Marshall, Horowitz, Lipson, & Lucido, 1989). As a result, it is now almost universally accepted that prior topical knowledge exerts a significant impact on reading comprehension and retention processes (Anderson, 1985). This conclusion stems in large measure from a series of studies that employed purposely ambiguous passages which could be given a distinct non-dominant interpretation by a specific subgroup of readers (Anderson, Reynolds, Schallert, & Goetz, 1977; Reynolds, Taylor, Steffensen, Shirey, & Anderson, 1982; Steffensen, Joag-Dev, & Anderson, 1979). In these studies, readers of different experiential backgrounds tended to interpret the ambiguous passages in a manner consistent with their presumed schema. This same basic trend occurred in subsequent replication studies although the impact of prior knowledge was diminished somewhat by supplying passage titles, by varying the situational context or setting in which the passages were read, and by altering the research paradigm (Carey, Harste, & Smith, 1981; Henk & Helfeldt, 1987; Sjogren & Timpson, 1979).

Interestingly, our widespread acceptance of the role of prior knowledge in text comprehension may be tenuous to the extent that our evidence hinges on existing ambiguous passage studies. While these investigations cleverly and earnestly broke new ground, they may be less than definitive on two crucial counts, both of which center on untapped factors that may have influenced the findings. The purpose of the present

study was to address these two factors and thereby extend our understanding of prior knowledge's influence on text interpretation.

A first major concern about extant ambiguity studies is that the researchers tended to presume the availability and intensity of readers' schema based solely upon their group membership (e.g., music majors, African-Americans, Hebrews, Indians). Across these studies, no direct measurements of prior knowledge were made to ensure that readers possessed relevant, specialized, and sufficiently robust topical schema. For instance, in a classic study by Anderson, Reynolds, Schallert, & Goetz (1977), it was assumed that physical education majors held a potent schema for competitive wrestling, an assumption that, however likely, remains unverified. Perhaps more importantly, since the amount of prior knowledge readers possessed about the competing topical domains was unknown, it is difficult to discern the true nature and magnitude of any relationship between prior knowledge intensity and text interpretation trends.

A second, related concern about the ambiguous passage studies is that readers' interest in the topic or, what we term 'level of involvement', was also unknown. Researchers apparently believed that the subgroups were sufficiently interested and involved with the domain of their expected interpretation to allow for schema availability, access, and deployment. As with prior knowledge, no direct measurements were made of readers' levels of involvement, thus eliminating the possibility of detecting the potential interplay between these two factors and their separate and combined influence on text interpretation. This oversight is noteworthy insofar as it has been shown that prior knowledge and interest/level of involvement do not share the same continuum (Baldwin, Peleg-Bruckner, & McClintock, 1985; Osako & Anders, 1983). That is, a reader may have low prior knowledge of a

topic but be keenly interested and involved with it. Likewise, a reader may possess high domain knowledge of topics that they find largely uninteresting or somewhat undesirable in terms of direct participation.

The present study sought to clarify the role of prior knowledge in ambiguous text interpretation by directly measuring readers' knowledge of, and level of involvement with, three distinct topical domains that could be assigned during reading of an ambiguous passage. Specifically, the research questions were: 1) Do subjects reliably interpret ambiguous text in a manner consistent with their group membership?; 2) What combination of variables best predicts free recall and multiple-choice interpretations of ambiguous text?; and 3) What relationships exist between subjects' respective levels of prior knowledge and their levels of involvement?

Method

Subjects

A total of 52 subjects participated in the study. All subjects were athletes competing in one of three interscholastic spring sports for two high schools located in northcentral Illinois. One high school was small and rural while the other was a rather large suburban type. The three sports represented in the sample were tennis (n=20), golf (n=16), and baseball/softball (n=16). There were two females in each group. Subjects were all juniors or seniors of average or above average reading ability. Their socioeconomic status qualified as low to average middle class.

Procedure and Materials

Subjects were tested at regularly scheduled organizational meetings of spring sports teams during February. They were told that: a) they would be reading a short story and then answering a series of questions related to it, b) the questions would be given to them in a packet containing specific

written directions for them to follow, and c) they were to read the passage only one time at a normal rate of speed and to proceed through the test packet without looking backward or ahead. No time limits were imposed.

An original 388-word ambiguous passage was devised that could be taken to be about tennis, golf, or baseball. The passage departed from previous studies in that it could be assigned three distinct interpretations. This provision allowed for a more acute test of a prior knowledge effect because each interpretation represented a specific sub-schema of a more generalized shared domain of sports knowledge. The passage read as follows:

> As Dave prepared to swing, his attention was drawn to the grim numbers appearing in the distance. Despite the radiant sunshine and the clear blue skies, he wore a deeply troubled expression. He knew full well that this would be his last chance to make up for the errors he had made earlier in the day. Now would be the time to make his move. Though looking calm and in control, his opposition seemed to be faltering. This was the break he had needed.
>
> What a day to play poorly! Dave was aware that nearly anyone interested in this grand old sport would be watching him perform on television this day. It was simply the most important event his sport had to offer. A commanding lead had been blown and Dave felt that in spite of the distractions of the crowd, he had no one else but himself to blame for his momentary lacks of concentration.
>
> He took a deep breath and readied himself to hit the ball. All the pressure riding on this swing made it nearly impossible to relax and hit the ball naturally. He had to clear his mind of everything else and concentrate on that somewhat scuffed ball. This was the day he had dreamed about since childhood. All those long hours of practice would be on the line now. As he assumed the stance and sighted the ball, he thought that it had never looked smaller. Still, he mustered up all his strength knowing that at this point anything less than a smash would spell certain defeat. Eyeing the ball with a singleminded intensity, Dave tore into it with a savage blow. His weight was distributed perfectly and all the elements of the swing looked like they had come straight from the textbook. The mere sound of the swing caused spectators to hold their breath in anticipation of the timely, clutch feat they were witnessing. The path of the ball was truly a thing to behold, piercing the air like a shot from a howitzer. Then suddenly, without warning, a vicious gust of wind arose which made the ball, though hard as it was hit, hook sharply to the right. Dave's heart sank as he watched the ball sail to where his mighty swing was all in vain. His opposition breathed a temporary sigh of relief.

It was expected that baseball would prove to be the dominant interpretation since most individuals would tend to possess at least a rudimentary schema for the sport through life and school involvement. Schemas for tennis and especially golf were expected to be more specialized. Category norm research by Battig and Montague (1969) supported these contentions.

Following reading, subjects wrote a free recall. They were instructed to write down as much about the passage as they could remember, trying to use the author's words whenever possible. They were also told to be sure to use their own words in order to provide a thorough account of the characters, setting, and story events. Here we were looking for subjects' use of terms that had not appeared in the passages (elaborations) but whose presence signaled specific text interpretations (e.g., racket, club, bat).

Next, subjects were told to respond to a set of 17 multiple-choice probes on the basis of what they had thought while reading the passage. For each probe, a direct question was followed by five randomly-ordered choices. The choices represented either a tennis, golf, baseball, indeterminate, or incorrect interpretation. A sample question (with designation noted parenthetically for clarification) follows:

11. How did the swing look to someone who understood the fine points of the game?

    a. good racket preparation, smooth execution, and proper follow-through (TENNIS)

    b. as awkwardly executed as possible (INCORRECT)

    c. as picture perfect as possible (INDETERMINATE)

    d. powerful and level, with a stride toward the mound (BASEBALL)

    e. head down, a nice high backswing, and hip rotation toward the green (GOLF)

Subjects were then asked to complete separate tests of prior knowledge for tennis (TPK), golf (GPK), and baseball (BBPK). Each of the three tests consisted of 13 completion items that required the subject to supply content-specific vocabulary terms from the respective domains (e.g., love, eagle, slider), a paradigm for assessing prior domain knowledge suggested by Johnston (1983). None of these terms had been used either in the passage or in the multiple-choice probes. Alpha reliabilities for the tests were .76 (TPK), .79 (GPK), and .81 (BBPK).

Finally, subjects responded to three separate instruments designed to measure their level of involvement with tennis (TLI), golf (GLI), and baseball (BBLI). The first 11 items of each instrument were Likert types. Item stems were followed by five ordered responses that ranged essentially from no involvement to intense involvement. For data analysis, these points corresponded to scores from 0 to 4. Fifteen additional statements of involvement, each worth one tally, followed each Likert set. Subjects were to check those statements that applied to them. A total score for subjects' level of involvement with each sport (maximum=59) was derived by adding the Likert responses (0 to 44) to the number of checked statements (0 to 15).

Analysis and Results

Computations of simple percentages served as the preliminary analyses for both the free recall and multiple-choice interpretation data. Generally, descriptive data are presented first for the entire sample of subjects and then with regard to the three actual sports groups.

For the free recall data, a subject's use of a single elaborative term that pointed to a particular interpretation was taken to mean that this interpretation had been assigned. Roughly 71% of the protocols contained such elaborations and the mean number of elaborations per protocol measured

3.1 (SD=1.71). No formal regard was made of the intensity of the interpretation (i.e., the use of two or more terms was not considered a stronger demonstration of interpretation than one term). Across all subjects, there was not a single instance where any two such elaborations within a protocol indicated conflicting interpretations.

To some extent, the free recall protocols were nearly as ambiguous and non-committal as the passage itself, a recurring pattern in previous related studies (Henk & Helfeldt, 1987). Having been asked to use the author's words whenever possible, the subjects who provided an indeterminate rendition (28.9%) complied with the directive, avoiding the use of terms that obligated them to a specific interpretation either consciously or unconsciously. As expected, the majority of all subjects (57.6%) gravitated toward a baseball interpretation while only 7.7% of them indicated a golf version and even fewer (5.8%) offered a tennis version. By actual group, 75% of the baseball players interpreted the passage to be about baseball; about one-fifth of the golfers (18.8%) indicated a golf interpretation; and some 15% of the tennis players indicated a tennis interpretation. Sixty percent of the tennis players and 37.5% of the golfers assigned a baseball interpretation. Both of these groups tended to generate indeterminate protocols (golf=43.8%; tennis=25%) when not assigning a baseball interpretation. None of the tennis players assigned a golf interpretation and none of the golfers assigned a tennis interpretation.

For the multiple-choice data, a subject's interpretation was considered indeterminate unless a clear majority of the probes pointed to a specific interpretation. The designation of either a tennis, golf, or baseball interpretation required that eight or more probes reflected the interpretation and that no more than two probes pointed to one of the other

major topics. In the cases where specific interpretations were indicated (86.5%), the pattern of response tended to involve pairing a single interpretation (M=11.7 probes) with indeterminate responses (M=4.65 probes).

Overall the multiple-choice data revealed a somewhat different picture than the free recall results. Again, most subjects (55.8%) selected the baseball interpretation; however, in this analysis, golf interpretations ranked second in frequency (21.2%) followed by indeterminate (13.4%) and tennis (9.6%) types. Of special note was the fact that 50% of the golfers took the passage to be about golf and 25% of the tennis players settled on a tennis interpretation. For both of these groups, subjects who were non-committal in their free recalls tended to move toward schema-consistent interpretations when multiple-choice probes were used. Sixty percent of the tennis players and 31.3% of the golfers selected the dominant baseball explanation. Roughly twenty percent of the baseball players (18.8%) chose a golf version but none chose tennis. Once more, no tennis players took the passage to be about golf and no golfers took the passage to be about tennis.

To examine more specifically the relative impact of actual group membership, prior knowledge, and level of involvement on ambiguous text interpretation, these factors (and their respective subfactors) were entered into two multiple discriminant function analyses. In one analysis, free recall interpretations (tennis, golf, baseball, or indeterminate) served as the criterion variable. Likewise, these interpretation categories served as the criterion for the discriminant function analysis of multiple-choice data. Predictor variables for both analyses included: actual group membership, golf prior knowledge, tennis prior knowledge, baseball prior knowledge, golf involvement, tennis involvement, and baseball involvement.

When all predictor variables were entered for the free recall interpretations, a significant discriminant function was indicated that included: tennis involvement, golf prior knowledge, baseball prior knowledge, and actual group membership. Here the Wilks' lambda statistic was calculated to be .58, the equivalent of an F value of 2.29 with 12 and 119 degrees of freedom ($p < .01$). The resulting equation correctly classified 61.5% of the cases; that is, subjects' text interpretations could be predicted based upon responses relative to these four variables. This accuracy rate compares very favorably with chance probability.

When identical discriminant function procedures were applied to the multiple-choice interpretations, only the three level of involvement indices (GLI, TLI, BBLI) were found to be significant. For this discriminant function, Wilks' lambda measured .53 with a corresponding $F(9,112) = 3.72$, ($p < .0001$). Here 53.9% of the multiple-choice text interpretations could be predicted on the combined basis of golf, tennis, and baseball involvement. Noticeably absent from among the significant predictor variables in this equation were the various prior knowledge scores of the subjects and their actual group membership.

Secondary descriptive analyses focused on prior knowledge and level of involvement variables and their interrelationships. Means and standard deviations for these variables by actual group are presented in Table 1. Across all groups, the baseball prior knowledge test generated the highest scores and the least amount of variation. In fact, neither tennis players nor golfers tended to score as high on prior knowledge of their respective sports as they did for baseball. This may account, in part, for the large percentage of subjects who assigned the baseball interpretation in the free recall and multiple-choice tasks. As expected, both golfers and tennis

players did seem to know more about their respective sports than they did about the other. Baseball players performed nearly as well on the tennis and golf prior knowledge tests as individuals participating in those sports.

The level of involvement scores suggest that all three groups were rather highly involved with baseball although the baseball players did, in fact, exhibit the greatest amount. Surprisingly, golfers actually indicated a somewhat greater level of involvement with baseball than golf. Perhaps the rather high level of baseball involvement for golfers and tennis players account for the high baseball prior knowledge scores across groups. Understandably, tennis players and golfers indicated considerably greater participation in their respective sports than in the other. Baseball players tended to be involved moreso with golf than with tennis.

Insert Table 1 about here

Pearson Product-Moment correlations were computed for all combinations of prior knowledge and level of involvement measures. Correlations between tennis, golf, and baseball prior knowledge scores and their respective levels of involvement were all significant beyond the .0006 level (TPK/TLI = .46; GPK/GLI = .76; BBPL/BLI = .69). Likewise, relationships among the three prior knowledge measures were also statistically significant beyond the .005 level (TPK/GPK = .36; TPK/BBPK = .39; GPK/BBPK = .60). When tennis level of involvement was paired with golf and baseball measures, negative correlations occurred (TLI/GPK= -.30; TLI/BBPK = -.29; TLI/GLI = -.35; TLI/BBLI = -.21), the first three of which were statistically significant ($p < .04$). Apparently, high tennis involvement is associated not only with low golf and baseball knowledge but also with low golf involvement.

Discussion

The present investigation offers some rather interesting insights into the role of prior knowledge in text interpretation and provides rather strong support for directly measuring both reader prior knowledge and level of involvement in ambiguous passage studies.

Evidence for a prior knowledge effect due to group membership was observed especially in the case of the baseball players. In both the free recall and multiple-choice paradigms, three-fourths of the group interpreted the passage to be about baseball. And although the baseball interpretation proved dominant overall as expected, fully half of the golfers and one-fourth of the tennis players interpreted the passage in a manner consistent with their group membership on the multiple-choice task. These latter findings are important since both golfers and tennis players tended not only to hold a viable baseball schema, but also because their level of involvement with baseball approximated that of their own respective sports. Further support for the influence of prior knowledge comes from the fact that no golfers or tennis players took the text to be about the other sport in either interpretation paradigm. So while the results were hardly as ideal as all members of each athletic group indicating the expected corresponding interpretation, a modest trend for such a pattern was present.

At the same time, the inability to predict text interpretation more reliably seems to be associated with the presumption of prior knowledge based on group membership. The golfers and tennis players, despite direct participation, demonstrated somewhat less domain knowledge of their respective sports than they did of baseball. Also, baseball players knew nearly as much about golf and tennis as the participants themselves. In effect, these equivalences would limit non-dominant text interpretations by

golfers and tennis players if prior knowledge as measured herein was supposed to represent a driving force. While it could be argued that the sample was less than ideal for a study of this kind, we think naturalistic observations of levels of prior knowledge provide an informative scenario nonetheless, and in any event, serve as a control for misassumption.

Another important notion, borne out by the discriminant function analysis of the multiple-choice data, is that readers' level of involvement may be a determinant of ambiguous text interpretations. The combination of levels of involvement for tennis, golf, and baseball accounted for the only significant prediction equation. By contrast, readers' respective prior knowledge scores and their actual group membership did not play a significant role. However, since, in free recall, certain prior knowledge estimates and actual group membership did play a significant role in predicting text interpretations, it seems that for ambiguous passage studies to be complete, a range of variables including prior knowledge, level of involvement, and actual group membership need to be considered concurrently.

The study also indicates that the research paradigm itself can influence the findings. Whereas the free recall data showed a limited prior knowledge effect, the multiple-choice data suggested considerably more. Of course, some part of this disparity is due to the nature of any task that involves free recall of ambiguous information. It is also possible that the multiple-choice answer sets cued subjects to alternative interpretations, and upon post-reading reflection, they were somehow compelled to report these perceptions as what they thought during reading.

The interrelationships between the various prior knowledge and involvement indices offer considerable food for thought. Across subjects, high positive relationships were observed between each sport's respective

prior knowledge and level of involvement scores. Understandably, as level of involvement increases for a sport, an accompanying general increase in prior knowledge might be expected. Still, a sizeable amount of variance was not accounted for by these correlations suggesting that the factors, albeit related, do not occupy the same continuum. It was also noted that the prior knowledge measures were significantly related to each other. This finding suggests that subjects did indeed hold some common athletic schemata. Finally, some expected and yet some curious relationships emerged when the involvement variables were paired with each other and with prior knowledge scores other than those of their respective sport. Somewhat predictably, as tennis involvement increased, golf and baseball prior knowledge and golf involvement decreased. However, increases in golf involvement were associated with both baseball prior knowledge and involvement. Apparently, golf and baseball share some common ground that does not include tennis. Interestingly, those baseball players who assigned the text a golf interpretation in the multiple-choice task either possessed substantial prior knowledge of golf or were rather highly involved with it.

All things considered, this investigation suggests that the findings of earlier ambiguity studies should probably be reconsidered in light of the complex interrelationships that appear to exist between prior knowledge and level of involvement variables. Future studies need to discern both their separate and combined influence on text interpretation in general, not only with regard to ambiguous discourse. In fact, reading researchers would do well to continue examining both prior knowledge and level of involvement factors under a host of experimental paradigms and situational contexts and with a wide range of developmental and ability variables in mind.

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Table 1. Means and standard deviations for measures of readers' prior knowledge and level of involvement by group.

		PRIOR KNOWLEDGE (Max=13)			INVOLVEMENT (Max=59)		
GROUP		Tennis	Golf	Baseball	Tennis	Golf	Baseball
Tennis	M	7.4	2.8	7.8	31.8	11.8	27.0
	SD	3.31	2.10	1.74	8.59	6.68	8.80
Golf	M	5.6	7.2	9.3	11.9	30.0	32.4
	SD	4.11	2.51	2.18	7.59	8.92	11.64
Baseball	M	7.3	6.6	11.4	14.4	23.0	44.3
	SD	2.52	3.03	1.67	5.78	10.28	5.32